

Subject: ConocoPhillips Comments on Proposed Designation of Critical Habitat for SRKW
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Please find attached comments from ConocoPhillips Ferndale Refinery on the proposed Designation of Critical Habitat for the Southern Resident Killer Whale. Hard copy will be sent via US Mail to addressee. Thank you for the opportunity to submit, and your consideration of, these comments.

Tim Johnson
ConocoPhillips | Environmental Specialist – Ferndale Refinery | Ph: 360-384-8368

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Ferndale Refinery

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August 14, 2006

Ms. Donna Darm
Chief, Protected Resources Division
1201 NE Lloyd Blvd., Suite 1100
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Re: Comments of ConocoPhillips on Proposed Designation of Critical Habitat
for the Southern Resident Killer Whale

Dear Ms. Darm:

ConocoPhillips appreciates the opportunity to provide these comments on the National Marine Fisheries Service's ("NOAA Fisheries") proposal to designate critical habitat for Southern Resident killer whales pursuant to the Endangered Species Act ("ESA"). ConocoPhillips owns and operates the Ferndale Refinery, a crude oil processing plant located on the shores of Puget Sound 20 miles south of the United States/Canadian border.

ConocoPhillips is committed to sustainable operation and development and to responsible environmental stewardship. We have made significant efforts to prevent oil spills from occurring. Unlike whale watching boats, the presence of tanker vessels and any associated noise are not threats to killer whale habitat. Our outfall does not contain the types of contaminants that NOAA Fisheries has identified as a significant threat to killer whales. Nevertheless, we are in the process of modifying our wastewater treatment process and, by early 2007, will have state-of-the-art facilities in place that will further reduce contaminants in our effluent.

We believe that the combination of these efforts ensure that neither killer whales nor their habitat are adversely affected by our operations in Washington State. As such, NOAA Fisheries should exclude the area surrounding the Ferndale Refinery from any final critical habitat designation, since there is no conservation benefit to killer whales from a designation there. In addition, NOAA Fisheries should clarify in any final rule that the presence of large tanker vessels and any associated noise do not pose threats to the Southern Resident killer whales or adversely affect their habitat. Finally, any final rule should more clearly distinguish between organochlorine compounds such as polychlorinated biphenyls ("PCBs") and dichlorodiphenyltrichloroethane ("DDT"),

which NOAA Fisheries believes are a significant threat to killer whales and their prey, and polycyclic or polyaromatic hydrocarbons (“PAHs”), which have not been shown to adversely affect killer whales or their primary prey.

DETAILED COMMENTS

As a preliminary matter, ConocoPhillips joins in the comments submitted by the Western States Petroleum Association (“WSPA”). In particular, WSPA articulates grounds upon which NOAA Fisheries should exclude the Cherry Point area from the final critical habitat designation.¹ We believe an exclusion is appropriate given that the refineries at Cherry Point have not contributed to any decline in killer whale abundance and are not a threat to the species or its habitat, as explained in further detail below.

I. Oil Spill Prevention and Response Planning

ConocoPhillips agrees with NOAA Fisheries’ statement in its proposed critical habitat rule (“Proposed Critical Habitat Rule”) and supporting documents that “additional oil spill regulations are not needed to meet ESA Section 7 consultation requirements.”² Significant and overlapping regulatory schemes are already in place to address the risk of a spill and avoid impacts to marine resources. Myriad state, regional, federal and international regulatory and non-regulatory programs have successfully reduced the occurrence and probability of oil spill events in Puget Sound and ensure protection of killer whales and their habitat. Regulatory programs include, but are not limited to:

- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties
- International Convention for the Prevention of Pollution from Ships
- International Convention on Oil Pollution Preparedness, Response and Cooperation
- International Protocol on Preparedness, Response and Co-operation to Pollution Incidents by hazardous and Noxious Substances
- Federal Oil Pollution Act
- Spill Prevention, Control and Countermeasure Plans
- Facility Response Plans
- Federal Prevention and Enforcement Programs
- Coast Guard Port State Control
- Joint United States/Canada Response Team

¹ See Letter Re: “Proposed Rule to Designate Critical Habitat for Southern Resident Killer Whales; RIN 0648-AU38,” from Frank Homes (WSPA) to Chief, Protected Resources Division (NOAA Fisheries) at 2-5 and Appendix A (dated Aug. 14, 2006) (“WSPA Critical Habitat Comments”).

² 71 Fed. Reg. 34,571, 34,579 (June 15, 2006); *see also* National Marine Fisheries Service Northwest Region, “Designation of Critical Habitat for Southern Resident Killer Whales: DRAFT 4(b)(2) Report,” at 16 (June 2006) (“4(b)(2) Report”); Industrial Economics, Inc., “Economic Impacts Associated with Potential critical Habitat Designation for the Southern Resident Population of Killer Whales,” 3-10 to 3-12 (Final Draft Report) (June 1, 2006) (discussing oil spill prevention and response regulations and planning) (“Economic Report”).

- National Preparedness for Response Exercise Program
- Northwest Area Committee and Work Groups
- Memorandum of Agreement on Strengthening the State/Coast Guard Partnership
- State Approval of Vessels and Oil Handling Facilities³

In addition to these regulatory programs, ConocoPhillips and other industry representatives have worked with state and federal agencies to ensure that oil spill prevention and response planning reflects the most protective measures possible. For example, in cooperation with the Olympic Coast National Marine Sanctuary, we helped establish an “Area to be Avoided” to move vessel traffic entering and leaving the Strait of Juan de Fuca away from sensitive areas. Through the Puget Sound Harbor Safety Committee, we helped develop the Puget Sound Harbor Safety Plan and Standards of Care, which focus on reducing the risk of a spill. ConocoPhillips and other industry representatives in the United States and Canada instituted the International Tug of Opportunity System to track and identify tugs for vessel support within Puget Sound. In addition, we supported placement of an equitably funded dedicated tug at the entrance of the Strait. As part of the Northwest Area Committee, we helped develop the Puget Sound Area Contingency Plan and have been instrumental in testing the protection strategies for sensitive areas throughout Puget Sound. Finally, we continue to work closely with the Coast Guard and Outer Coast Logistics Project to develop a database to identify logistical and communications needs. These are just some of the voluntary efforts being made by ConocoPhillips and others in Washington State’s petroleum industry to ensure that we effectively minimize oil spill related risks in Puget Sound.

The regulatory and non-regulatory programs described above have resulted in Puget Sound possessing the lowest commercial vessel oil spill rate in the nation for cargo vessels transiting in and out of our waters. From the 1970s through the 1990s, there was a 94-percent reduction in average annual oil spill volumes from all vessel types. There have been no documented drift grounding oil spill incidents in Puget Sound in over several million monitored vessel transits since the Vessel Traffic Service was implemented in the 1970s.⁴

Given the significant overlapping regulatory and non-regulatory oil spill prevention and response programs in place, NOAA Fisheries is correct in stating that no further regulations are required to meet ESA section 7 consultation requirements for any designated killer whale habitat.⁵ The industry has effectively minimized the risk of oil spills and has substantial protections in place to protect marine species and habitat. As such, there are no additional measures that could be required pursuant to section 7 to

³ Comments submitted by WSPA to NOAA Fisheries on proposed recovery planning describe each these regulatory programs in detail. *See* Letter Re: “Proposed Recovery Planning Process for Southern Resident Killer Whales,” from Frank Holmes (WSPA) and Michael Moore (Pacific Merchant Shipping Association) to Donna Darm (NOAA Fisheries) dated July 3, 2006 (“WSPA Recovery Planning Comment Letter”).

ConocoPhillips incorporates WSPA’s Recovery Planning Comment Letter by reference and requests that NOAA Fisheries include it in its administrative record for a final killer whale critical habitat designation.

⁴ WSPA Recovery Planning Comment Letter at 3 (citing U.S. Coast Guard Oil Spill Compendium, 2001).

⁵ *See supra*, note 2.

further minimize potential impacts to killer whales and their habitat from oil and gas transport and production in Puget Sound.

II. Vessel Traffic and Noise

As discussed in Section I, above, tanker vessel movements are highly regulated by numerous federal laws and international treaties. To ensure that additional conditions are not unnecessarily placed on oil tanker traffic, NOAA Fisheries' final critical habitat designation should clearly distinguish between the effects of vessel presence and sound from large vessels like oil tankers and that of recreational boaters and whale watchers in describing vessel-related threats to Southern Resident killer whale habitat.

The Proposed Critical Habitat Rule and its supporting documentation recognize that certain vessels can present obstacles to free passage by killer whales, causing them to swim further and change direction more often and potentially increasing their energy and foraging behavior.⁶ Although the Proposed Critical Habitat Rule often uses the broad characterization "vessel traffic" in describing these types of adverse effects, in fact the balance of all of NOAA Fisheries' Southern Resident killer whale documents – including the agency's listing decision, Proposed Conservation plan, Proposed Critical Habitat Rule and documents supporting the proposal – clearly identify recreational boaters and whale watching vessels as the sole vessel traffic-related threat to killer whale habitat.⁷ NOAA Fisheries recognizes that the ability of killer whales to pass freely among areas is not affected by large vessels such as military and Coast Guard ships and ferries.⁸ Like these large ships, oil tankers do not affect Southern Resident killer whale habitat, and any final critical habitat rule should make that fact clear.

In terms of the potential effects of vessel noise, NOAA Fisheries' killer whale documents are misleading when they suggest that the threshold levels at which underwater sound harms killer whales is poorly understood.⁹ That statement -- which is used broadly in the Proposed Conservation Plan and ESA final listing determination to apply to all vessel noise -- derives from the 2002 Southern Resident killer whale status report, which only

⁶ 71 Fed. Reg. at 34,576; *see also* National Marine Fisheries Service Northwest Region, "Designation of Critical Habitat for Southern Resident Killer Whales: Biological Report," at 32 (June 2006) ("Biological Report").

⁷ *See, e.g.*, 70 Fed. Reg. 69,903, 69,908 (Nov. 18, 2005) (citing concerns over compliance with whale watching guidelines, potential Marine Mammal Protection Act violations, and increased numbers of vessels engaged in whale watching as one reason for listing Southern Resident killer whale as "endangered"); National Marine Fisheries Services, "Proposed Conservation Plan for Southern Resident Killer Whales (*Orcinus orca*)," at 83- 89 (dated Aug. 2005; released Oct. 3, 2005) (dedicating 6 pages to the adverse effects of whale watching traffic and one paragraph to acoustic – but not traffic-related – effects of "other vessels") ("Proposed Conservation Plan"); 71 Fed. Reg. at 34,580 (identifying message to boaters and whale watchers to operate vessels responsibly as primary value of designating critical habitat in Area 1); 4(b)(2) Report at 18-19 (stating that education of whale watchers is "crucial" to successful killer whale conservation efforts).

⁸ 71 Fed. Reg. at 34,578; Economic Report at 1-5.

⁹ *See, e.g.*, Proposed Conservation Plan at 83; 70 Fed. Reg. at 69,908 (ESA final listing decision).

makes that statement in the context of discussing *whale watching vessels*, not large commercial vessels or tankers.¹⁰ In fact, unlike recreational boating and whale watching, large commercial vessels are associated with low frequency sound in the 0.005 to 0.5 kHz range.¹¹ NOAA Fisheries states in its Proposed Critical Habitat Rule that the lower range of the killer whale's hearing ability is 1 kHz, and the most sensitive portion of its hearing range is from 18 to 42 kHz.¹² Thus, while there may be some uncertainty regarding the effect of higher frequency vessels like recreational boaters and whale watchers, NOAA Fisheries does know that the lower frequencies emitted by large vessels are outside of the killer whale's most sensitive range. Any final critical habitat rule should be careful not to link statements regarding the uncertain effect of noise from whale watching vessels to large vessels like oil tankers, and should clarify that there is no evidence that sound at frequencies of 0.5 kHz or less is harmful to killer whales.

III. Polyaromatic Hydrocarbons

NOAA Fisheries' final critical habitat rule should clearly distinguish between organochlorine compounds such as PCBs and DDT, which NOAA Fisheries believes are a significant threat to killer whales and their primary prey, and insignificant levels of PAHs, which have not been shown to adversely affect killer whales or their prey. In particular, ConocoPhillips objects to representations in the independently prepared Economic Report, which is provided in support of NOAA Fisheries Proposed Critical Habitat Rule, that PAHs are "of concern" to killer whales and their habitat. These statements are erroneous, unsupported and inconsistent with the remainder of NOAA Fisheries' listing, conservation planning and critical habitat documents.

NOAA Fisheries has clearly identified organochlorines like PCBs and DDTs and emerging contaminants like flame retardants as posing a serious threat to killer whales and their habitat.¹³ The agency's "endangered" listing notice noted that high levels of those contaminants had been documented in Southern Resident killer whales.¹⁴ These contaminants were identified as having the ability to induce immune suppression, reproductive impairment and other physiological effects.¹⁵ Similarly, NOAA Fisheries' Proposed Conservation Plan spends 10 pages discussing PCBs, DDTs and other potentially harmful contaminants.¹⁶

Conversely, neither NOAA Fisheries' Proposed Critical Habitat Rule nor its listing notice suggest a connection between PAHs and killer whale decline, or identify PAHs as a future threat to killer whales or their habitat. Similarly, the Proposed Conservation Plan

¹⁰ Proposed Conservation Plan at 83 (citing Krahn, et al. 2002, "Status review of southern resident killer whales (*Orcinus orca*) under the Endangered Species Act," at 56).

¹¹ Proposed Conservation Plan at 89 (stating that large vessels emit low frequencies of 5 to 500 Hz).

¹² 71 Fed. Reg. at 34,572.

¹³ See 71 Fed. Reg. at 34,573; Proposed Conservation Plan at 72-82; Biological Report at 14.

¹⁴ 70 Fed. Reg. at 69908.

¹⁵ *Id.*

¹⁶ Proposed Conservation Plan at 72-82.

only notes, in passing, that PAHs are one of several chemicals that can be toxic at high levels, and later, that levels in Puget Sound are significantly higher than exist elsewhere,¹⁷ but does not suggest any link to the health of Southern Resident killer whales. NOAA Fisheries' only proposed conservation measure related to PAHs is to test ambient air quality *near whale watching vessels* to determine whether killer whales are inhaling high levels of PAHs.¹⁸

NOAA Fisheries' focus on chemicals other than PAHs is entirely appropriate. Trophic level increases of PAHs through biomagnification have not been observed in aquatic ecosystems because PAHs are commonly metabolized.¹⁹ Consequently, PAHs are not available to top predators such as killer whales.²⁰ In any case, fish species with the highest potential to be contaminated are bottom fish, which contribute very little to the Southern Resident killer whale diet.²¹ These conclusions are supported by research conducted by the British Columbia Department of Fisheries and Oceans on contaminant levels in Southern Resident killer whales, which found extremely high levels of PCBs and DDTs and lower levels of dioxins and furans, but did not report finding PAHs.²²

Unfortunately, the Economic Report supporting the Proposed Critical Habitat Rule mistakes the passing references to PAHs in the Proposed Conservation Plan (namely, that PAHs are one of several chemicals that can be toxic in high levels, and that PAHs are present in Puget Sound²³) and concludes that PAHs "are a concern" like PCBs.²⁴ The Economic Report makes these statements in the context of discussing potential changes in National Pollution Discharge Elimination System ("NPDES") limits. Similarly, the Economic Report includes a list of PAHs in its Exhibit 3-1, which is entitled "Waters in Puget Sound Impaired by Contaminants of Potential Concern to Killer Whales."²⁵ In fact, however, NOAA Fisheries has *not* identified PAHs as a concern to killer whales in its listing document, Proposed Conservation Plan, Proposed Critical Habitat Rule, or its accompanying NOAA Fisheries-drafted Biological Report or 4(b)(2) Report. The Economic Report's inclusion of PAHs as "of potential concern" to killer whales or their habitat is therefore erroneous and must be corrected by NOAA Fisheries in its final draft form.

Similarly, NOAA Fisheries' should ensure that its final critical habitat rule and all supporting documents do not use overly broad statements like "contaminants and pollutants" when intending to refer to specific organochlorines, flame retardants, and

¹⁷ Proposed Conservation Plan at 72, 81.

¹⁸ *Id.* at 106.

¹⁹ See Attachment A at 2 (citing McElroy et al. 1989; Broman et al. 1990).

²⁰ *Id.* at 2.

²¹ *Id.* at 4.

²² *Id.* at 3 (citing Schmidt and Johnson 2001).

²³ See *supra*, note 17.

²⁴ Economic Report at 3-3 (citing a March 2005 preliminary draft of the Proposed Conservation Plan); see also *id.* at ES-6.

²⁵ Economic Report at 3-4.

other specific contaminants.²⁶ Given NOAA Fisheries' continual references to the potential for a final critical habitat designation to result in changes to NPDES permit standards,²⁷ broad statements such as this are significant to those whose effluent contains "contaminants and pollutants" but does not contain the specific types of contaminants -- in particular PCBs and DDTs -- that NOAA Fisheries has identified as a potential threat to killer whales and their habitat.

IV. Exclusion of Ferndale Refinery Area

NOAA Fisheries articulates the benefits of designating critical habitat in the northern Puget Sound, Strait of Juan de Fuca, Haro Strait and Georgia Strait ("Area 1") as: (1) improving the ability of ESA section 7 consultations to focus on salmon abundance as an essential feature of the killer whale's habitat; (2) possibly improving water quality management activities; and (3) educating recreational boaters and whale watchers about operating their vessels responsibly in the area.²⁸ None of these potential benefits relate to oil tankers or refineries in Area 1.

The fact that there is no anticipated benefit from a critical habitat designation in Area 1 that relates to oil tankers or refineries is not surprising. NOAA Fisheries has identified no adverse affects from refineries in the area except the potential for oil spills and, as discussed above, the agency does not anticipate that the industry would be required to do more under the ESA section 7 standard to prevent or respond to spills.²⁹ Thus, there is no potential for a critical habitat designation to provide additional conservation benefits to killer whales in the areas adjacent to the Ferndale Refinery.

Conversely, there is significant potential for NOAA Fisheries' final critical habitat rule to be significantly misconstrued -- as was done, for example, in the Economic Report supporting the Proposed Critical Habitat Rule.³⁰ This could lead to the imposition of additional limitations on the Refinery's PAH effluent, for example, when such contaminants are not alleged by NOAA Fisheries to be a threat to critical habitat. Similarly, the designation could be misread to require measures to minimize large vessel noise, or to re-route vessel traffic, when large vessel presence and noise are not threats to killer whales or their habitat. These opportunities for misinterpretation and misapplication present significant legal and financial risk that ConocoPhillips should not be forced to bear given that designating areas around the Ferndale Refinery will provide no conservation benefit for killer whales.

Because the benefits of excluding the area around the Refinery outweigh the (non-existent) benefits of designation, the area around the Refinery should be excluded from

²⁶ See, e.g., Biological Report at 31.

²⁷ See, e.g., 71 Fed. Reg. at 34,578 (table 1); *id.* at 34,579; Economic Report at ES-6, 3-7 to 3-8; 4(b)(2) Report at 14 (table 1), 16.

²⁸ 71 Fed. Reg. at 34,580.

²⁹ See *supra*, note 2.

³⁰ See *supra*, notes 23 and 24 and accompanying text.

any designated critical habitat consistent with WSPA's Critical Habitat Comments.³¹ Furthermore, NOAA Fisheries should carefully craft its final critical habitat designation to avoid the types of misconceptions described above to the extent possible regardless of where it finally designates critical habitat.

V. Conclusion

Thank you for the opportunity to provide these comments and to assist NOAA Fisheries in developing a final rule on critical habitat for the Southern Resident killer whale. If you have any questions regarding these comments, please contact me at (360) 384-8407.

Sincerely,



Gary A. Solari, P.E.
Health, Safety, and Environmental Manager

cc: Frank Holmes, Northwest Manager, Western States Petroleum Association
Cherise Oram, Stoel Rives LLP

³¹ See WSPA Critical Habitat Comments at Appendix A.

ATTACHMENT A

Polyaromatic Hydrocarbons and Southern Resident Killer Whales August 11, 2006

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An overview of polyaromatic hydrocarbons (PAHs) is provided below followed by an assessment of their effects on the southern resident killer whale population and its prey in Washington state waters. The overview includes a description of the sources, pathways, metabolism, and toxicity of PAHs on mammals, fish, and invertebrates. Little is published on killer whales and even much less on the southern resident killer whale population. Since this population is unusual in that it preys entirely on fish, the discussion of effects of PAHs on prey is limited to fish.

Overview

PAHs (Polycyclic Aromatic Hydrocarbons) are a group of chemicals formed from the incomplete burning of coal, oil and gas, wood, garbage, or other organic substances (ATSDR, 2006). They also are found in petroleum and petroleum-based products (plastics, creosote, roofing tar, asphalt, etc.). The petrogenic PAHs (geochemical alteration of organic matter from petroleum spills, coal fired plants, etc.) are more available biologically to aquatic life than the pyrogenic (incomplete combustion of organic matter) PAHs (Thorsen et al. 2004). True PAHs have two to seven benzene rings composed solely of carbon and hydrogen with alternating single and double bonds between the carbons in the ring structure. There are more than 100 different PAHs, which generally occur in the environment as complex mixtures. PAHs are found throughout the abiotic and biotic environment in the air, water, and soil. PAHs are a less widely recognized marine contaminant (Marine Mammal Commission 1999), and they are usually assessed as a mixture of substances included with chlorinated pesticides (DDT and its derivatives), polychlorinated biphenyls (PCB), dioxins, furans, and metals, which are considered hazardous to animals. Because PAHs are metabolized by animals (Niimi, A.J. and V. Palazzo 1986), their contribution to marine contamination is typically confounded and overshadowed by other more prevalent, persistent, and toxic chemicals.

PAHs enter the environment mostly as releases to air from volcanoes, forest fires, residential wood burning, and exhaust from automobiles and trucks. They also enter surface water through discharges from municipal combined sewer outfalls, industrial plants and waste water treatment plants, spills of chemical or petroleum. Because of

these sources and their affinity for particles, some PAH compounds occur in elevated concentrations in sediments and hazardous waste sites. PAHs in general possess low solubilities in water. They are present in air as vapors or attached to the surface of small solid particles, which can be transported to the marine environment by stormwater run off. They can come from geographically distant locations by traveling long distances before returning to earth in rainfall or particle settling. Some PAHs evaporate into the atmosphere from surface water, but most stick to solid particles and settle to the bottoms of marine environments and the adjacent rivers and lakes. Some PAHs evaporate from surface soils to air. Consequently, there are many sources of PAHs making it impossible to define the relative contribution of each source to the overall PAH levels in most regions including Washington state marine waters (Barrick and Prah 1987).

Mammals, fish, and many invertebrates (crustaceans, polychaetes, echinoderms, insects) have well-developed mixed-function oxidase (MFO) systems, which enable them to efficiently metabolize and excrete some of the hydrocarbons ingested during feeding, grooming, and respiration (Lee 1977; Engelhardt 1983; James 1989; Rattner et al. 1989; Jenssen et al. 1990; Eisler 2000). As with microbes, large aromatic hydrocarbons (e.g. petroleum) are the most difficult group of hydrocarbons to excrete, regardless of MFO capability (Varanasi et al. 1989; Eisler 2000). Accumulation of PAHs is mostly associated with body lipid content, food habits and distributions that coincide with areas with elevated PAH concentration (e.g. superfund sites) of (McElroy et al. 1989; Eisler 2000). Trophic level increases in accumulation (i.e., biomagnification) have not been observed in aquatic ecosystems (McElroy et al. 1989; Broman et al. 1990), since it is more common for an animal to metabolize rather than accumulate and transfer PAHs up the food chain. This is not the case for chlorinated pesticides (DDT, etc.) and chlorinated hydrocarbons (such as PCBs) (Schmidt and Johnson, 2001). Consequently, PAHs are not available to top predators such as killer whales, and they are largely confined to animals feeding or living in contaminated sediment.

The mechanism of toxicity for PAHs seems to be interference with cellular membrane function and enzyme system associated with the membrane (Neff 1985). Although unmetabolized PAHs can have toxic effects, a bigger concern in animals is the ability of reactive metabolites (epoxides and dihydrodiols) of some PAHs to bind to cellular proteins and DNA causing mutations, developmental malformations, tumors, and cancer (Santodonato et al. 1981; Eisler 2000). While these potentially lethal as well as sublethal effects (from very low concentrations) are associated with chemical or petroleum spills and hazardous waste sites, environmental concentrations of PAHs in water are usually several orders of magnitude below levels that are acutely toxic to aquatic organisms (Albers and Loughlin 2003). Sediment PAH concentrations can be much higher than water concentrations, but the limited bioavailability of these PAHs greatly reduces their toxic potential (Eisler 2000).

Killer Whales

Limited information is available on the effects of PAHs on killer whales and their prey in Washington state waters as well as elsewhere in their range. Similarly, information on the effects of specific fractions (PAHs, etc.) of petroleum on killer whales and other marine mammals is very limited and much more focused on the physical and toxic effects of whole crude or refined petroleum on marine mammals. Petroleum is a source of the two-six benzene ring PAHs that are most resistant to microbial degradation and are most likely to settle into sediments (Colvell and Walker 1977; Neff 1985; James 1989). In the sediments, they may be ingested by lower trophic animals including macroinvertebrates and microorganisms (Albers and Loughlin 2003). However, the effects of PAHs are primarily limited to aquatic life that feed at the surface of the sediments or within the sediments, and they do not have the propensity to transfer up the food chain to killer whales.

The southern resident killer whale population has a high level of chemical contamination but the detectable chemicals have not been reported to include PAHs (Schmidt and Johnson 2001). Research by the British Columbia Department of Fisheries and Oceans found PCBs and DDTs at extremely high levels, lower levels of dioxins and furans, and higher levels of PCB and DDT in males than females, suggesting females excrete over 60% of their chemical residues through nursing (Ross et al. 2000). They did not report finding PAHs (Schmidt and Johnson 2001).

Prey

The southern resident killer whale population feeds exclusively on fish, primarily salmon. Salmon comprise 96% of the prey during late spring through and fall, when the resident killer whales inhabit Washington inland waters (Ford and Ellis 2005). Chinook salmon are selected over other species, comprising over 70% of the salmon taken by them (Ford and Ellis 2005). Other salmonids eaten in smaller amounts included chum (22%), pink (3%), coho (2%), sockeye (1%), and steelhead (<1%). Small proportions of a wide variety of bottom fish (rockfish, ling cod, halibut, sole, etc.), herring, and squid have been reported during predation events of resident killer whales (Ford and Ellis, 2005). Consequently, fish species (bottom fish) with the highest potential to be contaminated by PAHs contribute very little to the diet of resident killer whales.

PAHs have been implicated in effecting the health of some salmon, herring, and some bottom fish (English sole) from sediments in highly contaminated areas of Puget Sound (Puget Sound Water Quality Action Team, 1998) and Prince William Sound (WWW.AFSC.noaa.gov/ABL/OilSpill/pstoxici.htm). Elevated mortalities of pink salmon embryos were found in contaminated sections of streams in Prince William Sound affected by the Exxon Valdez oil spill. Embryos exposed to aqueous PAH concentrations showed an increase in mortality and reduced growth compared to unexposed fish. Juvenile salmon from the contaminated Duwamish River estuary; English sole from contaminated Hylebos waterway in Commencement Bay, Dyes Inlet, Elliott Bay, and Duwamish River; rockfish in Elliott Bay, and herring in Fidalgo Bay

were found to have PAH metabolites as well as PCBs, DDT (and its derivatives), as well as other toxic compounds and metals (Schmidt and Johnson 2001, Redman et al. 2006). Concentrations of PAH metabolites were highest in bottom fish, followed by herring in these urban areas, but were low for all species in non-urban areas (Schmidt and Johnson 2001). Major sources of PAHs in Elliott Bay were combined sewer overflows and possibly stormwater (King County DNR 1998). PAH inputs from the latter have declined in recent years, but the status of stormwater contributions is unknown (King County DNR 1998). While resident killer whales eat a wide variety of fish, fish species (bottom fish) with the highest potential to be affected by PAHs contribute very little to their diet, and the resident population is not known to regularly feed in the toxic urban areas of Puget Sound.

Conclusions

The following conclusions can be made about the effects of PAHs on the southern resident killer whale population and its prey:

- There is no evidence that PAHs adversely effect the southern resident killer whale population, since trophic level increases (biomagnification) of PAHs have not been observed in aquatic systems.
- The greatest concentrations of PAHs are in highly contaminated areas not regularly visited by resident killer whales in Puget Sound.
- The potential for PAHs to affect the prey of the resident killer whale population is likely quite small, since species most vulnerable to PAH contamination represent a very small proportion of their diet.
- The migratory nature and mid- to surface-water feeding habits of salmon greatly reduce their exposure to PAHs compared to most bottom fish that spend their entire life in a relatively small area feeding in the sediment. Salmonids also go to sea; hence they are less exposed to residues of PAHs from local sources than in-Sound resident species.
- The contribution of some industry point sources, such as petroleum refineries, in Puget Sound to PAHs in the marine environment is small compared to the large number of sources and pathways in the region.¹
- To the extent that there may be an effect on some southern resident killer whale prey and subsequently killer whales, it is overshadowed by the prevalence of more toxic, persistent, and biologically available chemicals, including PCBs, DDTs and its derivatives, dioxin, and a variety of metals or organometals like tributyltin.

¹ See, e.g., Letter from G.E. Goodman (ConocoPhillips) to Department of Ecology, Attn: Office of Comprehensive Programming (dated Jan. 12, 2006) (forwarding 2004-2005 human health criteria monitoring results prepared by Whatcom Environmental Services).

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